

CLAIMS:

What is claimed is:

1. A free-standing particle comprising:
at least two surface-enhanced spectroscopy-active outer regions; and
a spectroscopy-active analyte positioned between said outer regions;
wherein the particle has a maximum length of at most 300 nm.
2. The particle of claim 1, wherein said spectroscopy is Raman spectroscopy.
3. The particle of claim 1, wherein said outer regions have the same chemical composition.
4. The particle of claim 1, wherein said outer regions have different chemical compositions.
5. The particle of claim 1, wherein said outer regions comprise a metal.
6. The particle of claim 5, wherein said metal is selected from the group consisting of Au, Ag, Cu, Na, K, Cr, Al, and Li.
7. The particle of claim 1, wherein a distance between said outer regions is selected to maximize the intensity of a spectroscopic signal from said analyte.
8. The particle of claim 1, further comprising at least one spacer material positioned between said analyte and at least one of said outer regions.
9. The particle of claim 1, further comprising an encapsulant at least partially surrounding said outer regions and said analyte.
10. The particle of claim 1, wherein said analyte has a thickness of between 0 and 50 nm.

11. The particle of claim 1, wherein said analyte has a thickness of between 0.5 and 2 nm.

12. The particle of claim 1, wherein an amount of said analyte ranges between a single molecule and a multi-layer of molecules.

13. The particle of claim 1, wherein said analyte comprises a polymer.

14. The particle of claim 1, further comprising a capture molecule attached to an outer surface of said particle.

15. The particle of claim 1, wherein said particle is a rod-shaped particle.

16. The particle of claim 1, wherein said surface-enhanced spectroscopy is selected from the group consisting of surface-enhanced resonance Raman spectroscopy (SERRS), surface-enhanced infrared absorption spectroscopy (SEIRA), surface-enhanced hyperRaman spectroscopy (SEHRS), and surface enhanced hyperRaman resonance spectroscopy (SEHRRS).

17. An ensemble of differentiable free-standing particles, each particle having a maximum length of at most 300 nm and comprising:
at least two surface-enhanced spectroscopy-active outer regions, and
a spectroscopy-active analyte positioned between said outer regions;
wherein said particles comprise analytes yielding different spectra.

18. The ensemble of claim 17, wherein said spectroscopy is Raman spectroscopy.

19. The ensemble of claim 17, wherein each particle further comprises an encapsulant at least partially surrounding said outer regions and said analyte.

20. The ensemble of claim 17, wherein said analyte has a thickness of between 0.5 and 2 nm.

21. The ensemble of claim 17, wherein each particle further comprises a capture molecule attached to an outer surface of said particle.

22. The ensemble of claim 21, wherein different particles comprise different capture molecules.

23. The ensemble of claim 17, wherein said particles are rod-shaped particles.

24. A method for optically tagging an object, comprising associating with said object at least one particle comprising:
at least two surface-enhanced spectroscopy-active outer regions; and
a spectroscopy-active analyte positioned between said outer regions.

25. The method of claim 24, wherein said object is a biomolecule.

26. The method of claim 24, further comprising obtaining a spectrum of said particle.

27. A method for conducting an assay, comprising:

- a) attaching to a first ligand a first particle comprising at least two surface-enhanced spectroscopy-active first outer regions and a spectroscopy-active first analyte positioned between said first outer regions, thereby creating a first coated particle;
- b) contacting said first coated particle with a solution containing an analyte capable of associating with said first ligand; and
- c) acquiring a spectrum of said first coated particle.

28. The method of claim 21, further comprising:

contacting at least a second coated particle with said solution, said second coated particle comprising a second ligand attached to a second particle comprising at least two surface-enhanced spectroscopy-active second outer regions and a spectroscopy-active second analyte positioned between said second outer regions, said second analyte having a different spectrum from said first analyte and said second ligand being capable of associating with a different analyte from said first ligand; and

acquiring a spectrum of said second coated particle.

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